REMARKS

This amendment is being filed in response to the Office Action mailed November 27, 2009. Reconsideration of the application is respectfully requested. Claims 1-16 were previously cancelled. Claims 17-39 were pending and rejected. Editorial amendments have been made to the claims. These amendments are fully supported by the specification; no new matter is added. Further, since the amendments are merely editorial in nature, the amendments to not require new search. For reasons set forth below, Applicants submit the amendments place the application in condition of allowance.

Rejection of Claims 17-23 under 35 U.S.C. § 103(a)

In "Claim Rejections - 35 USC § 103" on pages 3-6 of the Action, claims 17-23 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,933,146 to Wrigley (hereinafter "Wrigley") in view of U.S. Patent No. 6,597,359 to Lathrop (hereinafter "Lathrop"). However, because at least one element of the claims is not taught nor suggested by the combination of Lathrop and Wrigley, Applicants therefore respectfully argue that the Action fails to make a *prima facie* case of obviousness.

Rejection of Claims 17-23

Independent claim 17, as amended, recites, in part:

> Performing by the computing device, a first intersection computation between the object of intersection and the ray;
> storing, by the computing device, the object of intersection in a list; and
> after the object of intersection is stored in the list, preventing, by the computing device, further performing of intersection computations after performing the first intersection computation between the object and the ray.

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For example, the Application describes the use of a "mailbox" for a ray. The mailbox stores objects as the ray intersects them and prevents future intersections from being computed with the objects:

> For purposes of further optimization, a decision unit is used that prevents objects or triangles that have already been intersected by a ray cast during ray tracing from being intersected by the ray again. This is effected by expanding the list unit by a mailbox, as shown in FIG. 2. *When a ray is cast, this mailbox notes which objects or triangles the ray intersects and prevents any one triangle or object from being intersected more than once by the ray. As a result, fewer ray-object, i.e. ray-triangle, intersection computations need to be carried out, and this accelerates the computation.* The mailbox may be seen as a kind of intersection-computation cache, which, unlike a memory cache, does not prevent memory requests to the memory but prevents intersection computations instead.

[Application, at page 11, last paragraph.] In its rejection of claim 17, the Action states that "Wrigley does not clearly disclose after the object of intersection is stored in the list, preventing . . . the object from being intersected again by the ray." [Action, at page 4.] However, the Action asserts such disclosure is found in Lathrop.

Applicants note that the rejection, which previously found disclosure in Lathrop at the Abstract and at column 2, now cites to new portions of Lathrop. [*See, id.*] Applicants respectfully assume from the Action's change in citation that the Examiner agrees that the previously-recited claim language is not found in Lathrop at either the Abstract or at column 2. As such, and because the foregoing amendments are editorial in nature, in the interest of compact prosecution Applicants will not reiterate their previous arguments over Lathrop, but instead will note that those for at least those reasons previously discussed, neither the Abstract nor the cited-to portion of column 2 of Lathrop teaches or describes the above-quoted language of claim 17.

Applicants respectfully submit that Lathrop likewise does not teach or describe the amended claim language.

Lathrop's directed acyclic graph, which is cited to in the Action, contains nodes directed to portions of space, not objects, and thus does not teach "storing . . . the object

of intersection in a list" as recited in claim 17. In its rejection, the Action cites to Figures 4-9 and column 7, lines 57-62 of Lathrop. [*See,* Action, at page 4.] The Figures provide examples of various directed acyclic graphs, or "DAGs." The passage of Lathrop also describes one implementation of a DAG representing a space:

> In the preferred embodiment, the shape of the scene volume represented by each DAG node is convex. This yields the advantage that a ray will enter and exit the volume represented by any particular DAG node no more than once. In other words, no ray will never enter, exit, and then re-enter any volume represented by a DAG node.

Applicants first note that in the passage cited by the Action, Lathrop explicitly states that a "scene volume" is represented by Lathrop's DAG, rather than an "object" as recited in claim 17. This aspect of Lathrop, where spaces are represented in the DAG, is spelled out in greater detail with reference to Figure 4, which is also cited in the Action:

> FIG. 4 shows an example of such a DAG . . . . The DAG contains nodes 20-25. *Node 20 is the top node, and represents the entire scene area 26. . . . Node 21 is a leaf node, and represents the scene area A. Node 22 is a parent node that represents the union of areas B, C, and D. Each of the remaining nodes 23-25 are leaf nodes representing the areas B, C, and D respectively.*
> In the DAG according to the preferred embodiment, parent nodes contain only links to one or more child nodes, and leaf nodes only contain references to zero or more scene objects. *A leaf node must reference all the objects that could intersect a ray within the scene volume represented by that node.*

[Lathrop, at column 7, lines 24-38; emphasis added.] As the Lathrop's discussion of the DAG shows, the DAG cited to by the Action consists of nodes which represent a spaces (or areas, in the case of the two-dimensional example given in Figure 4). The nodes themselves clearly *do not* themselves represent objects, given that the only nexus described between nodes and objects is that of "leaf nodes" which can reference "zero or more scene objects." As there is no indication given that the nodes in the DAG can represent objects, Applicants respectfully submit that the DAG described in Lathrop does not teach "storing . . . the object of intersection in a list" as recited in claim 17.

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Lathrop's space-based graph does not prevent objects from being intersected with a node more than once, and cannot teach "after the object of intersection is stored in the list, preventing, by the computing device, further performing of intersection computations after performing the first intersection computation between the object and the ray" as recited in claim 17. As Figures 5, 8, and 9 of Lathrop illustrate, an object may be found in more than one space. Thus, even if Lathrop's DAG were considered to read on the "storing . . . the object of intersection in a list" language of claim 17, the storage of an object cannot necessarily "prevent[] . . . further computing of intersection computations . . . between the object and the ray" as recited in the claim language. For example, if Figures 5 and 6 of Lathrop are compared, the ray illustrated in Figure 6 is likely to intersect object 28 in both areas B and C. Yet, according to the teachings of Lathrop, in the passage cited in the previously Office action mailed August 31, 2009, because the ray intersects both area B and C, the ray is intersected with objects in each of these two areas:

> The space subdivision techniques subdivide the scene volume instead of the list of objects. The scene space is subdivided into chunks. The data for each chunk contains a list of all the scene objects that could result in a positive ray/object intersection check within the chunk. . . . *The ray is checked for intersection with all the objects in each chunk before proceeding to the next chunk along the ray.*

[Lathrop, at column 2, lines 52-57; emphasis added.] Because the ray would be intersected with objects in each area, the example shown in Figures 5 and 6 would result in the ray being intersected with object 28 *twice*, rather than once. Thus, despite being "stored" in a "list," as the Action would argue, Lathrop would still not be able to "prevent[] . . . further computing of intersection computations . . . between the object and the ray."

For at least these reasons, the rejection of claim 17 fails to establish a *prima facie* case of obviousness over Wrigley and Lathrop. Claim 17 should be allowable over Wrigley and Lathrop. Additionally, while Applicants do not individually belabor the rejections of dependent claims 18-23, Applicants note that each claim recites, based on independent claim 17, at least one element not shown in Wrigley and Lathrop for the reasons discussed above. Claims 17-23 are thus allowable over Wrigley and Lathrop.

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Applicants respectfully request that the rejection of claims 17-23 under § 103(a) be withdrawn and that claims 17-23 be allowed.

Rejection of Claims 24-29 and 32-38 Under 35 U.S.C. 103(a)

In "Claim Rejections - 35 USC § 103" on pages 7-12 of the Action, claims 24-29 and 32-38 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,933,146 to Wrigley (hereinafter "Wrigley") in view of U.S. Patent No. 6,597,359 to Lathrop (hereinafter "Lathrop").

Independent claims 24 and 32 each recite language similar to that discussed above with respect to claim 17. Claim 24, for example, recites:

> a decision unit operatively configured such that, when ray-object intersection data has been computed for a given ray and a given object, the decision unit prevents additional ray-object intersection computations from being carried out for the given ray and the given object.

Claim 32, as amended, recites:

> for an object for which an intersection computation has been performed with a ray, prevent[ing] further performing of intersection computations between the object and the ray.

In its rejection of the above-quoted language of claims 24 and 32, the Action notes similar deficiencies in Wrigley as those discussed above with respect to claim 17, and cites to the same passage of Lathrop. [*See*, Action, at pages 7 and 9.] Thus, for at least the reasons discussed above with respect to claim 17, the rejections of claims 24 and 32 fail to establish a *prima facie* case of obviousness over Wrigley and Lathrop. Claims 24 and 32 should be allowable over Wrigley and Lathrop, as should claims 25-29 and 33-38, which depend from claims 17 and 32 respectively and thus incorporate the recitations of the independent claims. Applicants respectfully request that the rejection of claims 24-29 and 32-38 under § 103(a) be withdrawn and that the claims be allowed.

Rejection of Claims 30, 31, and 39 Under 35 U.S.C. 103(a)

Claims 30, 31, and 39 were rejected under 35 U.S.C. § 103(a) over Wrigley in view of Lathrop and further in view of U.S. Patent Application Publication No. 2004/0233222 to Lee et al. (hereinafter "Lee"). [*See*, Action, at pages 12-15.]

It is respectfully submitted that Lee does not make up for the lack of teaching in Wrigley and Lathrop as described above. Therefore, independent claim 24 remains allowable over Wrigley and Lathrop even when combined with Lee. Claims 30 and 31 depend from claim 24; for at least similar reasons to those discussed above, claims 30 and 31 are allowable over the cited references.

Claim 39, as amended, recites, in part:

> the decision unit configured to prevent objects whose object addresses are stored in the list from being intersected again by the ray . . . .

In its rejection of the above-quoted language of claim 39, the Action notes similar deficiencies in Wrigley as those discussed above with respect to claim 17, and cites to the same passage of Lathrop. Claim 39 is thus allowable over Wrigley and Lathrop. And, as with claims 30 and 31, Lee does not make up for the lack of teaching in Wrigley and Lathrop. Therefore, claim 39 remains allowable over Wrigley and Lathrop even when combined with Lee.

Applicants respectfully request that the rejections of claims 30, 31, and 39 under 35 U.S.C. § 103(a) be withdrawn and that the claims be allowed.

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CONCLUSION

In view of the foregoing, allowance of pending claims are solicited. If the Examiner has any questions concerning the present paper, the Examiner is kindly requested to contact the undersigned at (503) 796-2446. If any fees are due in connection with filing this paper, the Commissioner is authorized to charge the Deposit Account of Schwabe, Williamson and Wyatt, P.C., No. 500393.

Respectfully submitted,
SCHWABE, WILLIAMSON & WYATT, P.C.

Date: February 23, 2010   by: /Ryan C. Fox/
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